CHAPTER 4
ESTABLISHMENT OF TURF

4-1. General. The most critical factors in the selection and establishment of turf are: evaluation of existing site and climatic conditions; proposed use of the site under consideration; and maintenance requirements. Other information in this chapter is intended to aid in the actual establishment of turf once a selection is made. Included are site preparation, installation and establishment period.

4-2. Microclimatic conditions. Microclimatic conditions relate directly to the site and its environs. They cannot be shown on regional maps because of their site specificity.

a. Sun and wind exposure.

(1) *Sun.* The total amount of solar energy a given turf area receives is determined by the weather, land slope in relation to year-round solar angles and degree of shading by other vegetation and buildings. South-facing slopes will normally have a hot, dry microclimate; north-facing slopes are usually cool and moist because of lower direct solar input and reduced evapotranspirational loss compared with south-facing slopes. In some situations, a different turf variety will be required for each side of the slope. Shade-tolerant cultivars should be considered when sun exposure is limited.

(2) *Wind*. Wind affects turfgrass adaptation in several ways, the most critical of which is as an abrasive force. Turf subjected to high winds may be damaged if it is not resistant to abrasive wear. The use of protective mulch is required for the establishment of turf in areas where high winds prevail.

b. Existing grade and drainage. Excess surface water can adversely affect the quality of turfgrass by reducing its vigor, creating a shallow root system and increasing the potential for compaction and disease if water is not removed by either surface or subsurface drainage. Existing drainage conditions give clues to potential drainage problems and opportunities for improvement. Since surface drainage is related to the grade of a site, sites with natural slopes are usually more easily drained than flat sites. Subsurface drainage will take place naturally if the subsurface soil has suitable permeability and structure.

c. Existing vegetation. Permanent vegetation on a site affects wind movement, humidity, temperature and sun exposure to varying degrees, depending on the density and height of tree crowns and spacing between individual trees and shrubs.

(1) *Density of the tree crown.* Evergreen vegetation has most effect on microclimate conditions since the tree crown is dense and foliage is retained throughout the year. The seasonal loss of foliage by deciduous vegetation provides an opportunity for increased sun exposure and turf growth. Sun exposure may be increased near trees by pruning lower branches to a height of S to 10 feet.

(2) *Spacing between individual trees and shrubs.* Thinning may be desirable in areas with dense vegetation, especially if vegetation is diseased or damaged.

4-3. Proposed use of the site. Careful consideration should be given to the anticipated use of an area before turfgrass selection is made. Depending on the intensity of use and the level of anticipated maintenance, there are three categories of use: improved, semi-improved, and unimproved. The application of these categories is as follows:

a. Improved grounds. Improved grounds include acreage on which intensive maintenance activities must be performed annually. Included are areas within the built-up section of an installation which contain lawns and landscape plants, parade grounds, drill fields, athletic facilities, cemeteries, golf courses (excluding roughs) and similar areas. Maintenance operations include mowing, irrigation, fertilization, cultivation, aeration, seeding, sodding, spraying, pruning, trimming, weed control, insect and disease control, planting for landscape effect, wind and sound abatement and other intensive practices.

b. Semi-improved grounds. Semi-improved grounds include areas on which moderate, periodic maintenance is performed. Included are small-arms ranges, antenna facilities, picnic areas, mowed road shoulders, golf course roughs, ammunition storage areas, firebreaks and similar areas. Maintenance practices normally include such cyclic variables as soil sterilization, weed and brush control, erosion and dust control, drainage maintenance and mowing for fire protection.

c. Unimproved grounds. Unimproved grounds include all other acreage not classified as improved or semi-improved. Included are bombing and gunnery areas; impact, training and maneuver areas; forest areas; agricultural and grazing lands, lakes, ponds and swamps; beaches; and similar areas requiring limited or no maintenance. Maintenance practices are those which might be required by the military mission; soil, water and wildlife conservation; floods and fires; and insect or disease epidemics.

d. Use in relation to existing conditions. The intensity of use and level of maintenance determine both cat-

egories of use and the impact on the immediate environment. Environmental impact will be greatest in improved areas, because the site is altered to provide for intensive use and high maintenance. Unimproved areas have the least impact on the existing environment because very little, if any, site preparation is done and maintenance is minimal. A blending of the two extremes creates a moderate environmental impact, such as in semi-improved areas where site preparation and maintenance are at moderate levels.

4. Selection of turf and turf alternatives.

a. Major regions of turfgrass adaptation. The adaptability of turfgrass species in different regions of the country is based primarily on tolerance of particular temperature conditions and season of most active growth for the cultivar. These regions are illustrated in figure 4-1 as three categories: warm-season, temperate or cool-season and a zone of transition. This is a highly simplified approach to the climatic diversity which exists within the United States. Therefore, it is recommended that local university agronomists, Agricultural Extension Service agents or USDA Soil Conservation Service district representatives be contacted for local guidelines. Warm-season grasses are those which have optimal growth during daytime temperatures of 80 degrees to 95 degrees Fahrenheit, and cool-season grasses prefer temperatures of 60 degrees to 75 degrees Fahrenheit. The transition zone is an area of overlap where some species of both warm and cool-season grasses can exist or adapt. The following paragraphs discuss the major characteristics of warm-season, cool-season and transition zone grasses. Individual species for each zone are discussed in appendix C.

(1) *Warm-season grasses.* These grasses grow most actively during the hot summer months and become inactive during the winter. During this winter dormancy

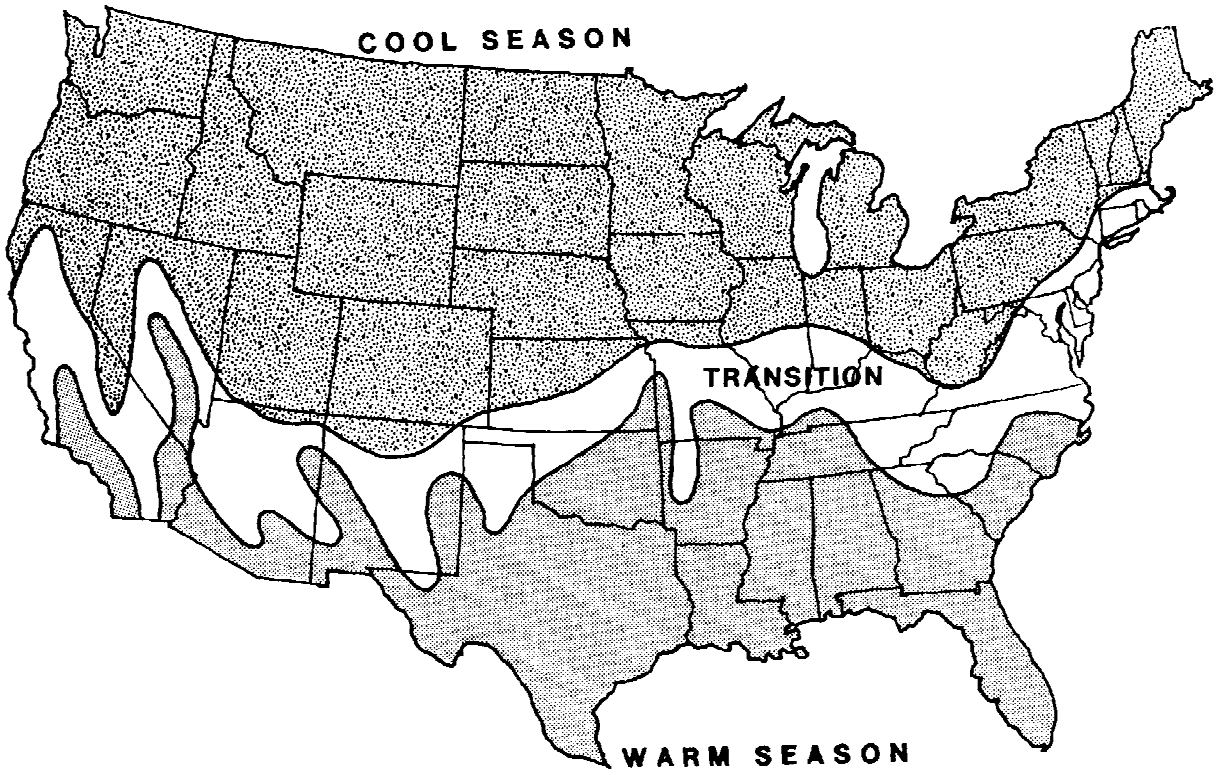

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Figure 4-1. Major regions of turfgrass adaptation in the United States.

period, the grasses turn brown. Overseeding with cool-season grasses will provide winter color and protection for year-round use. Most warm-season grasses are propagated by vegetative methods such as sprigging or stolonizing rather than by seeding. Major species of warm-season grasses are Bahiagrass, centipedegrass, Bermuda grass, St. Augustine and zoysia.

(2) *Cool-season grasses.* These grasses grow most vigorously during the spring and fall when temperatures are cool and experience a dormancy period during hot summer months. They retain their color throughout the winter and are usually propagated by seed, rather than vegetatively. Major cool-season grasses are bentgrass, Canada bluegrass, Kentucky bluegrass, chewings and red fescue, tall fescue and perennial ryegrass.

(3) *Transition zone grasses.* Because the transition zone is an area of overlap between warm and cool season grasses, the boundary shown in figure 4-1 should be used only as a guideline. Warm-season grasses, in order to be adaptive in this area, must display tolerance to cool conditions. Cool-season grasses, on the other hand, must be tolerant to heat and drought. In most cases, a given species as a whole will not display these qualities, though individual cultivars may. Bentgrass, Bermuda grass, Kentucky bluegrass, tall fescue and zoysia may be successfully grown in the transition zone.

b. Seed mixtures and blends. A more satisfactory stand of turf can often be provided by selecting a blend or mixture of species or cultivars than by use of any single variety. Selection of compatible turfgrass is based on similar texture, color and maintenance requirements. It is advisable to include grasses in the seed mixture which will increase disease tolerance, adapt well to moisture or temperature extremes, increase the range of tolerance to sun and shade, and improve the rate of establishment. Propagation of mixed grasses should be by seed only. For this reason, mixtures of warm-season grasses, most of which must be propagated vegetatively, are generally not considered practical. Usually only one or two grasses can be expected to persist longer than 5 years in a mixed turf. Grasses which do not contribute to a long-lasting turf should not be included in the blend except for use as nurse grass to provide quick cover for erosion control.

(1) *Common seed mixtures.* One of the most commonly used mixtures is Kentucky bluegrass (Poa pratensis) and chewings fescue (Festuca rubra). They are usually represented in equal proportions (50-50) except in areas with sandy, droughty soils or in deep shade. In these areas a higher percentage of chewings fescue is included (30-70). In the Pacific Northwest, an appropriate mixture for recreational areas is equal proportions (50-50) of Kentucky bluegrass and perennial ryegrass (Lolium perenne). In areas of the arid West, mixtures of native grasses are most appropriate. Blue grama (Bouteloua gracilis) and buffalograss (Buchbe dactyloides) are appropriate grasses for silt and clay loams in unimproved areas (75-25). In sands and sandy loams, the percentage of buffalograss should be replaced with sand dropseed (Sporobolus cryptandrus).

(2) *Nurse grasses.* Frequently, a mixture will contain a percentage of nurse grass. Nurse grasses are fast-germinating, temporary grasses which emerge prior to other grass species. They favorably alter the microclimate conditions of the site for other species and provide erosion control where applied mulches are impractical. Because of their competitive nature, nurse grasses should comprise less than 20 percent of the total mixture and should not be used in areas of low rainfall. Annual ryegrass (Lolium multifiorum) and redtop (Agrostic alba) are appropriate for use as nurse grasses.

(3) *Winter overseeding.* The practice of seeding cool- season grasses into an established stand of grass during the fall is known as winter overseeding. This practice is common in warmer regions of the country where Bermudagrass and other grasses become dormant in the winter. The practice of overseeding is not compatible with all dormant winter grasses, especially the dense-growing types such as St. Augustine, zoysia and centipedegrass. Winter overseeding provides the winter color, uniformity and active root growth required for year-round use. When warm temperature resume in the spring, the cool-season species die hack and the warm-season species again dominate.

(a) Improved or semi-improved areas. A single species or a mixture of species may be used for over- seeding to provide the desired qualities. Appropriate single species are rough bluegrass (Poa trivialis), red fescue (Festuca rubra) and annual ryegrass (Lolium multifiorum). Appropriate mixtures are tall fescue (Festuca arundinacea), red fescue and perennial ryegrass (Lolium perenne); bentgrass (Agrostis spp.), rough bluegrass and red fescue; Kentucky bluegrass (Poa pratensis), rough bluegrass and red fescue; and Kentucky bluegrass, tall fescue and perennial ryegrass.

(b) Unimproved areas. Either burclover (Medicago hispida) or crimson clover (Trifolium incarnatum) may be used for overseeding in unimproved areas.

(c) Alternatives to *turf.* In areas with poor site conditions, it is advisable to consider treatments other than turfgrass. The use of turfgrass alternatives generally reduce maintenance requirements.

(4) *Miscellaneous grasses.* Miscellaneous grasses which do not qualify as turfgrasses may be appropriately used in some situations. These grasses are often more tolerant to harsh conditions and can be more easily established, especially in areas of the arid West. Further information on local adaptation should be obtained from county Agricultural Extension Service agents, university

agronomists or USDA Soil Conservation Service district representatives.

(5) *Legumes and ground covers*. These plants, often of ornamental value, can be used where turf establishment or maintenance is difficult and where little or no foot traffic exists. Properly established and maintained ground covers will require less maintenance than turf-grass; however, initial maintenance (during the first one to three years) will be high. Many legumes and ground covers can be recommended as turfgrass alternatives; however, availability and climatic adaptation will determine final selection.

(6) *Wildflower mixes*. The seeds of mixed species of wildflowers may be substituted for all or part of the grass seed in a seed mixture. Wildflower plantings are appropriate for large flat areas or slopes in areas with little or no foot traffic. These plantings are limited to semi-improved and unimproved areas. Care should be taken to select self-sustaining species which are locally hardy and thrive without regular care or irrigation. Species should not be selected which produce large numbers of wind-borne seeds that may spread to other areas of the installation.

(7) *Artificial turf*. The use of artificial turf is generally not recommended due to cost and maintenance requirements.

(8) *Porous surfaces*. Porous surfaces of crushed rock or gravel aggregate may be used in areas where grasses cannot survive due to drought or poor soil conditions. In areas where irrigation is impractical, rainfall is low or soils are unproductive, a 1 to 2 inch blanket of gravel or crushed rock may be used. Crushed rock should be coarse enough to allow drainage.

4-5. Site Preparation.

a. Clearing and grading. The extent of clearing and grading in an area where turf is to be established will be governed by site use, land slope, climatic conditions and planting method. Clearing and grading should be minimized to avoid unnecessary dust and erosion. Prior to grading, reusable topsoil should be removed and stockpiled.

(1) All turf areas should be graded to have slopes not steeper than 3:1; 4:1 slopes are optimum. If slopes are too steep, mowing with standard equipment can be hazardous. Athletic areas should be graded with a 1.5 to 3 percent slope toward the sidelines, and lawn areas with a 1.5 percent slope away from buildings. In areas with pavement, turf grades should be established 1 inch below pavement grades. Abrupt or irregular grading makes maintenance more difficult and should be avoided. Swales should be preserved or installed during grading to receive and convey surface drainage. Vegetation should be preserved in swales where erosion potential is high.

(2) The final grading of a site will determine its potential for surface drainage. In extreme cases, such as sites with heavy clay soils, implementation of subsurface drainage may be necessary to remove excess water. When natural drainage is poor enough to warrant subsurface drain lines, alternatives to turf should be sought so that costs and maintenance problems can be minimized. TM 5-820-4/AFM 88-5, Chap 4 contains guidance for drainage in areas other than airfields.

b. Soil modification. The incorporation of amendments in an existing soil can improve soil texture and structure so that a high-quality turf can be established. Soil modification is especially appropriate in semi-improved and improved areas where the existing soil has a high clay or sand content. Soil amendments should be worked into the soil to a depth of 8 to 12 inches. In many cases, an adequate vegetative cover can be established without amending the existing soil. Where soil texture is expected to present a management problem, a mechanical analysis of the existing soil should be obtained and prospective sources of available soil amendments determined.

(1) *Sand.* The incorporation of large sand particles into clay soils will enhance aeration and water percolation, as well as reduce the tendency for compaction. It is necessary to incorporate at least 2 inches of coarse sand into the upper 6 to 8 inches of the existing soil to create adequate pore space. Use of ungraded sand with a high percentage of fine particles may intensify the problem rather than alleviate it.

(2) *Organic amendments.* The addition of organic matter improves soil structure and aeration and promotes nutrient and water retention. Sandy soils especially benefit from the addition of organic matter. The amount of organic material added to a soil may vary; however, recommended amounts for 1,000 square feet of soil are 3 to 4 cubic yards of well-rotted compost, 2 to 3 cubic yards of rotten manure or 3 bales of peat moss. Other materials which may be used are rotted sawdust or ground bark. Nitrogen deficiencies can occur if organic materials are not decomposed when they are added to soil.

(3) *Topsoil.* Topsoil is a select or mixed soil material applied to a soil surface prior to seeding or planting turf. Grading and provisions for surface drainage should be completed prior to the addition of topsoil. Replacement of existing topsoil is generally unnecessary except where there are disproportionate amounts of sand, silt or clay. In such eases, a gradual transition of soil material is necessary in order to provide good internal drainage.

c. Nutrient additives. Soil fertility can be adjusted by the addition of nutrients as determined necessary through soil testing.

(1) *Gypsum*. Gypsum is used to improve soils which have a high percentage of soluble salts. Where pH

is at the right level but the soil needs conditioning, especially if it is heavy clay, gypsum should be used. It has little effect on pH.

(2) *Lime.* Lime acts as an agent to increase the availability of nitrogen, phosphorus and potassium and other chemicals. Lime is commonly used in acid soils to raise pH to a less acid level. Common liming materials are ground limestone, hydrated lime, burned lime and marl. Lime should be applied at a rate and frequency determined by the combination of a laboratory soil test and the recommendation of a local turfgrass specialist. In areas where lime is required, it should be added two or three months prior to fertilization and mixed in the soil to a depth of 6 inches. The best season for application is late fall or early winter.

(3) *Sulfur.* The addition of sulfur lowers pH values and causes soil to become more acidic. Sulfur is very rarely added except in areas where soils are extremely alkaline.

(4) *Fertilizers.* A complete fertilizer is commonly used for turfgrass establishment, unless a soil test indicates otherwise. Fertilizers should be applied to the finished seedbed. Nitrogen fertilizers are divided into organic and inorganic types. Organic types release nitrogen slowly, providing for uniform stimulation over a long period of time and usually cost more per unit of actual nitrogen. Processed sewage sludge is an example of an organic nitrogen source. Inorganic fertilizers are water soluble and are available as dry materials which require thorough watering into the soil. Inorganic fertilizers must be applied in smaller quantities than organic types. The following are inorganic nitrogen fertilizers:

— Ammonium nitrate.
— Ammonium sulfate.
— Ammonium phosphate.
— Calcium nitrate.
— Nitrate of soda.
— Urea.

d. Tillage. Tillage may be desirable for one or more of the following reasons: loosening compacted soil, reducing soil erosion, destroying weeds or adding fertilizers and lime. Deep tillage may also improve soil drainage and promote the establishment of a deep root system.

(1) *Initial tillage.* An ideal seedbed is made by tilling the graded soil surface to a depth of 6 to 8 inches to eliminate areas that may be packed and bard. The tilling process also brings objectionable materials such as stones, stumps, large roots and building refuse to the surface, where they can be more easily removed. A disk harrow can be used to loosen the soil surface except in areas where heavy machinery has packed the soil. A disk plow or chisel-type tillage tool may be required on heavily compacted soils.

(2) *Pulverizing the surface.* The soil surface should be harrowed and raked level following tillage to prevent the formation of depressions. A fine-textured seedbed is important for initial seedling growth. Where large clods are present, a cultivator packer should be used instead of a harrow to pulverize clods.

(3) *Timing.* Seedbed preparation should take advantage of favorable soil moisture conditions. Soils should not be cultivated when wet, although compacted soils should be softened by rain or irrigation prior to tillage.

(4) *Grade elevations.* The soil surface should be true and even and grade elevations undisturbed to ensure that surface drainage is directed away from buildings and pavements and that there are no depressions where water will stand. The grade should be rechecked after the seedbed has been prepared. The final grade must be approximately 1 inch below adjacent sidewalk and runway elevations on lawns and airfields to prevent water from accumulating on the pavement and to permit efficient turf maintenance.

(5) *Correcting the grade.* The seedbed may settle considerably after a heavy rain or irrigation. Such settlement is seldom uniform but tends to occur in spots, leading to expensive replanting later. This is especially objectionable on lawns and recreational areas where a true final grade is essential. The soil surface should be checked for depressions and fill added to bring the grade to the correct elevation.

e. Protection of adjacent areas. Every precaution should be taken to avoid the disturbance of existing vegetation adjacent to the site. Major grading and the use of heavy equipment should be restricted to the outer drip lines of existing trees. Temporary fencing may also be advisable.

f. Erosion/Nonpoint source pollution control during site preparation. The implementation of best management practices (BMPs) can minimize and control erosion during preparation. Disturbed areas should be limited and soil surfaces should be left rough to enhance water infiltration. Stabilization and planting should be implemented as soon as possible after a site is disturbed. If a delay in planting is encountered, temporary mulching may be necessary. Soil erosion may be minimized by applying the following BMPs when applicable.

(1) The area of land that is exposed to erosion at any one time during construction should be limited.

(2) Temporary mulch should be applied on cleared areas of the construction site immediately after rough grading is completed.

(3) Sediment basins may be constructed to precipitate silt from storm runoff before it leaves the site.

(4) Temporary grade stabilization devices such as silt fences, diversion berms, water spreaders, sodded channels and asphalt flumes may be constructed.

(5) Permanent storm drainage systems and base course for all pavements should be installed at the earliest practical time.

(6) Final stabilization should be accomplished immediately after finish grading is completed. Mulch should be applied regardless of season, and seeding, sodding or sprigging delayed if necessary, until the season is most favorable for establishment of grass or ground cover.

g. Chemical soil treatment. When large numbers of noxious weeds or weed seeds are present, it may be necessary to chemically treat the soil before planting turf. Alternative treatments include pre-emergent herbicides, contact herbicides and soil fumigants. TM 5-629/NAVFAC MO 314/ AFM 91-19 contains guidance for use of these chemicals.

4-6. Planting operations.

a. Seed quality. Grass seed, as sold commercially, normally contains many impurities. Seed quality is dependent on the percentage of pure live seed contained in a particular species. Federal seed laws require that the containers of seed offered in interstate trade exhibit the percent germination and percent purity. The label will normally show each weed seed which is considered noxious by the state in which the test is made. Canada thistle, field bindweed, dodder, buckthorn, wild onion, quack grass and Johnson grass are common examples. Appendix C contains further information relating to seed quality.

b. Seasons most favorable for planting. The most favorable time for planting turfgrass is just before a 6 to 8 week period of optimum soil temperature and moisture. Although germination requirements vary according to species, seasonal preferences exist among grasses adapted to the same region.

(1) *Warm-season grasses.* The optimum time for establishment of warm-season grasses is late spring or early summer. Late summer or fall plantings are seldom successful and should be avoided.

(2) *Cool-season* grasses. Cool-season grasses should be planted in early fall or early spring. The chances of poor establishment increases with the approach of hot weather.

(3) *Transition-zone* grasses. Follow guidance as in (1) and (2) above.

c. Planting methods.

(1) *Seeding.* Mechanical seeding is the most common and least expensive method of planting turfgrass. Good results are dependent on uniform seed distribution, adequate soil cover over seeds and firm soil around the seed. Grass seed drills are the least desirable method for seeding turfgrass, because seeds are not distributed uniformly but in rows 6 to 8 inches apart. Seed drills will, however, reduce the seeding rate and may be appropriate on large or unimproved areas. Some seed drills may plant seeds too deeply. Broadcast seeders are the fastest method of seeding; however, a method for covering and firming the soil must follow, such as the use of a cultipacker. A broadcast seeder will not provide uniform distribution of seed mixes which contain seeds of different sizes and weights. Hydroseeding is appropriate for use in large areas. Seed is mixed with fertilizer, mulch and water, made into a slurry and applied in a one-step process. The greatest disadvantage of hydroseeding is that the seed is placed on the soil surface where it is more susceptible to the effects of drought.

(2) *Sprigging.* Sprigging involves the planting of turf stolons or rhizomes in shallow furrows 1 to 2 inches deep. Rows are usually 18 inches apart with sprigs placed 6 to 12 inches apart in the rows. In areas where rapid establishment is not crucial, rows may be up to 3 feet apart. Sprigs should be kept moist and planted immediately after digging. Plant shipments should be coordinated with the planting schedule to allow immediate planting.

(3) *Sodding.* Sodding is the most expensive method of planting turfgrass. The use of sod should be limited to areas where quick turf establishment is required to repair previously planted areas. For irrigated sites, uniform sod with a thickness ¾ to 1 inch is recommended. Sod should be free of objectionable grasses and noxious weeds. Sod installations on slopes require pegging to prevent significant slippage.

d. Mulching.

(1) *Applied mulches.* Surface erosion and damage from drying winds can be effectively controlled under most conditions by applying vegetative or manufactured mulches. On most planting sites, mulching offers substantial benefits by providing protection from wind and rain. Mulches influence conditions in the surface layers of the soil and thus aid in seed germination and establishment. Seasonal fluctuations in soil temperature are kept at a moderate level and water absorption is increased. Mulching is also helpful in weed control. Effective mulches include cereal straw, shredded bark and leaf mold. Hydraulic applications of wood cellulose fiber and/or recycled paper will provide considerable protection if applied at a sufficiently high rate. Woven net mulches, such as woven paper or jute, are not consistent in effectiveness. Sawdust and glass fiber are seldom acceptable. Mulch can be applied manually or mechanically.

(2) *Planted mulches.* Under some conditions, applied mulches are not practical. Some areas are so isolated that the purchase and shipment of mulch material are not cost-effective. In other areas, the planting of temporary cover crops may be the most economical method if time and site conditions permit. In situations where rainfall is abundant and the soil surface does not

erode severely, a permanent grass may be planted simultaneously with a nurse grass.

4-7. Establishment. The length of time necessary for turf to become established varies according to species, method of planting and site conditions. In most cases a reasonable establishment period is 3 months or until the turf has been mowed three times.

a. Watering. Maintenance of a moist soil surface is critical during the establishment period, especially where a durable, long-lasting turf is required. Immediately after planting, the soil should be thoroughly moistened. Light daily watering may be necessary for 2 to 3 weeks. Heavy applications of water which results in puddling and runoff will disrupt establishment and promote disease. The use of a mulch reduces the need for frequent watering.

b. Mowing. Mowing should begin when turf reaches a height one-third greater than the anticipated cutting height. Mowing should continue at the height and frequency required of the established turf. The initial mowing of areas established by sprigs should begin when sprigs reach a height of 3 to 4 inches, except for zoysia, which establishes best at a 1 inch height, Mowing should be done with sharp equipment on dry, firm soil.

c. Topdressing. Topdressing is applied to stoloniferous species to increase the formation of dense sod. A light covering with a material similar to the underlying soil is recommended. Top dressing should be applied at intervals of two to three weeks during the initial establishment period.

d. Fertilization. Under some conditions, application of fertilizer prior to planting may not be sufficient to maintain active plant growth during the establishment period. The need for a higher nitrogen level can be detected by stunted growth and a yellowish leaf color, especially where adequate moisture has been supplied. Seeded areas should not be fertilized until seedlings reach a height of 1 to 1½ inches. Sodded areas do not require fertilizer during the establishment period.

e. Weed control. Herbicides may injure the root system of new plantings and are usually unnecessary until after the establishment period. Weed control should not be necessary in sodded areas.

f. Traffic control. Seeded areas are especially susceptible to damage until turf is mature, and should he protected by barriers.

g. Repair of planting failures. Unexpected environmental conditions, such as lack of rainfall and unfavorable temperatures, can cause planting failures. Regardless of whether the failures are in large or small areas, repair should he prompt in order to take advantage of the planting season. If the planting season has expired, mulching will be necessary to protect the site until the next planting season. Low spots should be promptly filled and replanted. Areas where seeds have failed to germinate should be repaired by reseeding.